IN-05
135355

NASA TECHNICAL TRANSLATION

NASA TT- 20234
9 P.

PROCEDURE FOR DETECTION AND IDENTIFICATION OF A HELICOPTER

Hans Siebecker

(NASA-TT-20234) PROCEDURE FOR DETECTION AND IDENTIFICATION OF A HELICOPTER (NASA) 9 p CSCL 01C

N88-20297

Unclas
G5/05 0135355

Translation of "VERFAHREN ZUR DETEKTION UND IDENTIFIZIERUNG EINES HUBSCHRAUBERS", Federal Republic of Germany, German Patent No. 2851205

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
APRIL 1988

Disclosure Document 28 51 205

File Number: P28 51 205.2

Date Received: November 11, 1978

Date Declared: June 4, 1980

Description: Procedure for Detecting and Identifying a Helicopter

Supplement to: P 26 55 520.4

Applicant: Eltro GmbH, Corporation for Radiation Technology, 6900 Heidelberg

Discoverer: Siebecker, Hans, Dipl.Ing. Dr., 6901 Wiesenbach

P 78/12

20. November 1978

Ma/Rch/481

ELTRO GMBH, CORPORATION FOR RADIATION TECHNOLOGY

6900 Heidelberg, Kurpfalzring 106

Procedure for Detection and Identification of a Helicopter

Supplement to Patent # P 26 55 520.4

Patent Claims

1. Procedure for detection and identification of a helicopter on the basis of its characteristic energy radiation in the visible and/or heat-emitting range as well as in the sonic range, whereby for detection one of the properties of the helicopter as a heat-radiating pin point target is received by a detector (8), and whereby for identification visually modulated radiation from the helicopter rotor in the background **OR** characteristic background modulated rotor radiation in the infrared spectrum is received by a sensor. To determine the position on the horizon one of the two above named sensors is used in the elevation-controlling horizon sensors with the so-determined azimuth and elevation angle positions of the identified helicopter automatically fed to a fire-control computer - this is being done simultaneous to the weapon and observation equipment being pivoted into target position according to Patent P 26 55 520.5 thereby characterized that the identification sensor (11) is combined with a gas laser - the gas laser trained on the rotating

helicopter blades, the Doppler shift (in the laser) caused by the rotor blades and if needed, even the movement of the helicopter itself are used in combination for identification.

2. Procedure from Claim 1 thereby characterized that the gas laser is applied as a laser distance measurement device (34,35).

3. Procedure according to Claim 2 characterized by the use of a laser sender (34) in continuous or quasi-continuous operation with long impulses and characterized by the use of a laser receiver suited for heterodyne reception.

4. Procedure according to the preceding claim characterized by the use of a CO_2 laser as the gas laser.

5. Procedure from the preceding claim thus characterized that the reflected laser signal from the rotor blade with wide-band Doppler shift is filtered for the narrow-banded Doppler frequency component and inputted for identification (from the tip of the rotor blade); this allows a unique determination of the rotor blade frequency.

This discovery concerns a procedure for detecting and identifying a helicopter on the basis of its characteristic energy radiation in the visible and/or infrared light spectrum as well as in the acoustic wave range whereby for detection one of the properties of the helicopter as a heat-radiating pin-point target is received by a detector, and whereby for identification visually modulated radiation from the helicopter rotor in the background **OR** characteristic background modulated rotor radiation in the infrared spectrum is received by a sensor. To determine the position on the horizon one of the two above-named sensors is used in the elevation-controlling horizon sensors with the so-determined azimuth and elevation angle positions of the identified helicopter automatically fed to a fire-control computer - this being done simultaneousto the weapon and observation equipment being pivoted into target position.

This procedure makes use of a passive IR identification sensor which utilizes (via the rotor blades) modulated background radiation of a characteristic modulation frequency for identification of the helicopter type. This thoroughly usable process has however the disadvantage of a considerably limited range, especially in poor visibility conditions. The task of this discovery is seen to be the improvement of type classification procedures as regards instrument range increases. This task is thus solved according to the discovery in that the identification sensor is combined with a gas laser - the gas laser is aimed at the rotating rotor blades, the Doppler shift caused by movement of the rotor blades as well as movement of the helicopter itself (if necessary) are all used in identification of the craft.

Such a procedure possesses the advantage (as opposed to a passive process directed toward the reception of IR radiation) of independance of its range from the type and heating up of rotor blades. Moreover, its performance is increased by an improvement in laser efficiency - corresponding to need. As opposed to Doppler radar, this has the advantage of no stray radiation, close focus and good reflection properties for rotor blades in the infrared range of 10.6 micrometers wavelength. Additionally there is the possibility of sweep radiation selection via spectral filtering. Utilization of helicopter movement on the other hand serves for better selection from other objects like foliage being stirred by the wind.

Because with an active system its easier to measure the distance of an object this discovery provides that a gas laser is used as a distance measuring device. Further, it is advantageous when a gas laser sender in continuous or quasi-continuous wave operation with long impulses is used and when a laser receiver equipped for heterodyne reception is used. Compared to linear reception, heterodyne reception possesses greater sensitivity. Additionally, using this method greater efficiency is attained via smaller volume and weight. It is sensible to use a CO_2 laser as the gas laser. In the following the discovery will be explained with the help of an illustration and example.

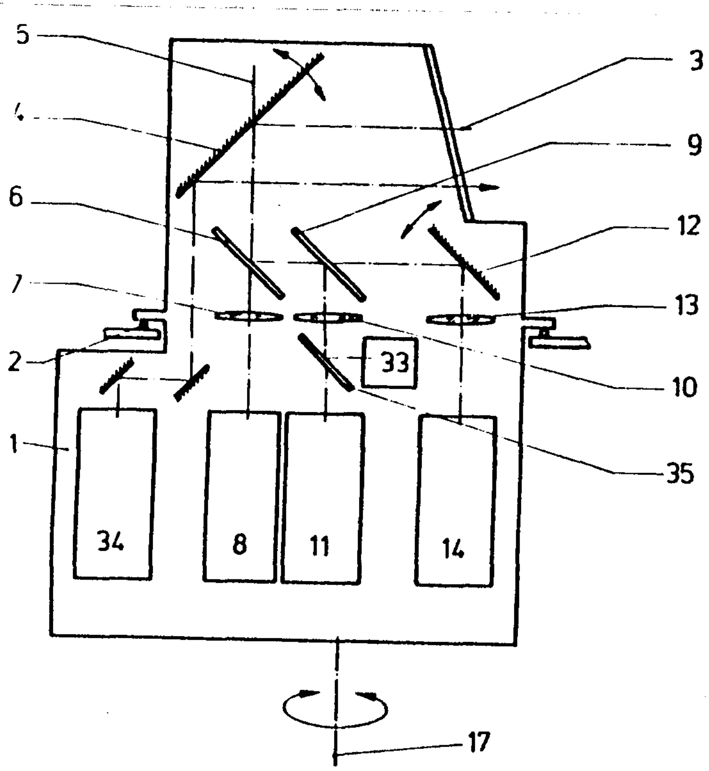
The sensor head (1) is azimuthally positioned with the help of a ball bearing (2). Radiation (3) from the "scene" is deflected across (in elevation) the moveable mirror (4) via axis (5) to the spectral divider (6). Finally radiation is transmitted for point selection on the objective lens (7) which is imaged on the detection sensor (8).

Radiation for the identification sensor (11) and the horizon sensor (14) is reflected in the direction of the spectral divider(9). This reflects for its part radiation provided for the identification sensor to objective lens (10) which images the radiation on the identification sensor. Radiation for the horizonsensor passes spectral divider (9), encounters next scanning mirror (12) and is deflected from there to objective lens (13) in order to be imaged on the horizon sensor.

Mirror (12) images the scene in the elevation direction and thereby determines the horizon position whereby oscillation frequency in the rotation velocity of sensor head (1) is tuned.

Deflection mirror (4) must be large enough to serve as image field for objective lenses (7), (10) and (13). Imaging of sensors(8) and (11) results via the rotation of sensor head (1) around its vertically coursing axis (17). For horizon sensor (14) supplemental elevation movement is necessary via the imaging mirror (12). In this respect this procedure corresponds to that of the main patent applicaton.

In order to increase the range, the identification sensor (11) is combined with the receiver (33) (laser distance meter whose sender (34) is preferrably a CO_2 laser) wherein splitting of the CO_2 laser radition results through a reflecting spectral filter (35) for the wave length range of 10.6 micrometer. The laser sender (34) works in continuous or quasi-continuous mode with long impulses, while the laser receiver (35) is intended for heterodyne reception.



NASA
National Aeronautics and Space Administration

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TT-20234		

4. Title and Subtitle	5. Report Date
PROCEDURE FOR DETECTION AND IDENTIFICATION OF A HELICOPTER	APRIL 1988
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
HANS SIEBECKER	
	10. Work Unit No.
9. Performing Organization Name and Address	11. Contract or Grant No.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON, DC 20546	NASW-4307
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	translation
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON, DC 20546	14. Sponsoring Agency Code

15. Supplementary Notes

Transl. from GERMAN into ENGLISH of "Verfahren zur detektion und identifizierung eines hubschraubers," Federal Republic of Germany, German Patent no. 2851205. Transl. by SCITRAN, Santa Barbara, CA 93150.

16. Abstract

A procedure is described for detecting and identifying a helicopter based on its char- istic energy radiation in the visible and heat emitting range, as well as in the sonic range. This procedure uses a passive IR identification sensor. The procedure is discussed using illustrations and examples.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
	unclassified-unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of pages	22. Price
unclassified	unclassified	9	